CLIMATE NARRATIVE, October 2020 and as noted

Climate_Narratives may be found, https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html
How can we predict the future if we cannot see the present? Jerrold.G.Norton@noaa.gov

UNITED STATES WEST COAST AND NORTH PACIFIC

During late **October** 2020, US west coast (20-200 km offshore) satellite derived sea surface temperature (SST_O) anomalies were positive from northern Mexico to Central California at SSTo between 17-20°C, neutral (average SSTo) to negative from Pont Arena to Central Oregon (10-17°C). Average SSTo was found to the north along the coast of Washington and southern Canada (10°-13°C). The area of negative SSTo anomaly along the US west coast was one of the few areas of the north Pacific (and Northern Hemisphere) north of 10°N that was not warmer than average during October. The Gulf of Alaska had positive anomaly exceeding 2°C. Other small areas of negative SSTo anomaly occurred in the central Pacific between 165°-177°W, 27-33°N and in the South China Sea west of the Philippines. South of 10°N, a tongue of negative SSTo anomaly stretched from the coast of South America westward to 160°E. Arctic sea ice area retreated to 3.7 million km^2 during mid-September, the lowest since 2012
https://coastwatch.pfeg.noaa.gov https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)
https://climatereanalyzer.org/wx/DailySummary/#sstanom (current) https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html
https://psl.noaa.gov/data/gridded/data.noaa.oisst.v2.highres.html
https://www.fisheries.noaa.gov/feature-story/central-gulf-alaska-marine-heatwave-watch?utm_medium=email&utm_source=govdelivery

Sea Level Height Anomaly (SLA) analyses for the Pacific Ocean (30°S-40°N) for late **October**, showed persisting negative SLA (≥-10 cm) along the coast of North America from the equator northward of 40°N. Between 10°-18°N these negative SLA anomalies extended west to 140°E. A trough of SLA anomaly deeper than -20 cm occurred between 10°-16°N, 140°-170°W. Another trough (≥-15 cm) occurred along the equator between 120°-170°W. Positive SLA was more common west of 180°E/W from the equator to 10°N and between 25°-40°N. Between 30°-40°N, SLA anomalies exceeded 20 cm west of 180°E/W.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif (current)

During late **October**, coastal areas with **surface chlorophyll-a** (chl-a) concentrations of 0.5- 2.5 mg/m^3 were seen in satellite imagery along shore from 28°-52°N. This coastal zone of high chl-a reached more than 300-500 km off the US west coast. Higher concentrations occurred within 100 km of the coast. North of 47°N, elevated chl-a reached from the US coast across the north Pacific. Coastal areas with 0.5-2.5 mg/m^3 were generally less developed alongshore southern California and northern Mexico. (30°-35°N). Lower chl-a oceanic water (0.05-0.09 mg/m^3) was found within 150 km of shore south of 30°N. Recent imagery is available.
https://coastwatch.pfeg.noaa.gov/coastwatch/CWBrowserWW180.jsp#
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)

Monthly sea temperature list from shore stations and **near-shore buoys,**

This List shows shore and nearshore water temperature measurement locations along the US west coast in decreasing latitude. Each line begins with a shore station or buoy abbreviation followed by latitude. Temperature values are in brackets with the average of available monthly values first (followed by the range and standard deviation) in parens and change from previous monthly mean. Averages for the first, second and third monthly terciles are within the second parens, followed by the multiyear monthly average, where available. Subscripts H and L show terciles containing highest and lowest monthly temperatures.

October temperatures showed: 1) overall range of 9.3°C., 2) anomalies from available multi-year means were all positive (0.4°-2.5°C, 3) standard deviations and change in temperature from September had values less than 1.0 from Arena Cove (ArCv) to Port San Luis (PrtS), 4) from Monterey (Mtry) northward temperature change from September was negative, except at the Eel River buoy (EelR); changes were also negative near shore at 32.9°N, 5) at Crescent City north and from Santa Barbara Channel south the highest temperatures occurred in the first tercile, 6) from the Eel River Buoy north and Santa Barbara Channel south, the lowest temperatures occurred in the third tercile.

Amphitrite Point, B.C., 48.9°N

Neah,48.5°N,124.7°W [11.3 (8.9-15.1, 1.4) -0.8 (12.4$_H$, 11.7, 9.9$_L$) 10.9°C]

Cape Flattery, 48.4°N

NeBy,48.4°N *[11.2 (8.5 -14.8, 1.43)0.0(12.4$_H$, 11.6, 9.7$_L$)°C]*

CpEz,47.4°N,124.7°W [13.6 (10.3-15.8, 1.6)-1.1(15.1$_H$,14.2, 11.7$_L$)12.3°C]

Cape Blanco, 42.8°N

PrtO,42.7°N *[10.8 (8.0- 14.6, 2.17)-2.0(12.7$_H$,11.1, 8.7$_L$)°C]*

CCty,41.7°N *[12.6 (9.0-15.5, 2.10)- 1.5 (14.8$_H$, 12.8, 10.2$_L$)°C]*

EelR,40.7°N,124.5°W [12.6 (9.6- 17.1, 1.8) 1.6 (13.2, 13.9$_H$, 10.7$_L$) 12.1°C]

Point Arena, 39°N

ArCv,38.9°N *[11.8 (10.5 -13.3, 0.64) -0.3 (11.6, 11.6$_L$, 12.1$_H$)°C]*

Point Reyes, 38°N

SFrn,37.8°N,122.8°W [13.9 (13.1-14.9, 0.33) -0.7 (13.9$_H$, 14.0L$_H$, 13.8$_L$) 13.8°C]

Mtry,36.6°N *[15.8 (13.5 -17.4,0.54) -0.3 (15.7$_{LH}$, 15.5$_L$, 16.2)°C]*

Point Sur, 36.3°N

PrtS,35.1°N *[16.1 (15.0-17.5, 0.52) 0.4 (16.0$_L$, 16.3$_H$, 16.2$_H$)°C]*

PtCn,34.5°N,120.8°W [17.3 (15.1-19.6, 0.76) 1. 1 (17.1$_L$, 17.5$_H$, 17.5)°C]

Point Conception, 34.4°N

SBCh,34.3°N,119.9°W [19.4 (16.6- 21.4, 1.2) 0.9 (20.2$_H$, 20.3$_H$, 18.0$_L$) 16.9°C]

SMca,34°N [19.9 (16.3 -22.5, 1.30) 0.1 (21.0$_H$, 20.4, 18.4$_L$)°C]

Tory,32.9°N,177.4°W [20.6 (18.2-23.3, 0.90) -0.6 (21.3$_H$, 20.8, 19.7$_L$)°C]

LaJo,32.9°N *[19.3 (14.3 -21.6, 1.73)-0.7 (19.4$_H$, 20.0$_H$, 18.8$_L$)°C]*

Point Loma, 32.7°N

Shore temperature measurements, taken at fixed depth below the lowest tide at NOAA **tide stations**, are in italics: *NeBy* (9443090), *PrtO* (9431647), *CCty* (9419750), *ArCv* (9416841), *Mtry* (9413450), *PrtS* (9412110), *SMca* (9410840), *LaJo* (9410230). (Numbers) lead to detailed location and station descriptions,
https://tidesandcurrents.noaa.gov/stations.html?type=Physical%20Oceanography

. Near shore buoy measurement details are obtained from number designations:

Neah (46087), CpEz (46041),TlMk (46089), EelR (46022), SFrn (46026), PtCn (46218), SBCh (46053),Tory (46225) . https://www.ndbc.noaa.gov/station_page.php?station=46087

EQUATORIAL AND SOUTH PACIFIC

During **October**, La Niña (cool phase ENSO) conditions persisted across the central and eastern equatorial Pacific (EP). La Niña is expected to continue through the northern winter. East of 150°W, negative EP subsurface (≤ 250 m) temperature anomalies (≥ -2.5°C) became more extensive. Positive subsurface temperature anomalies decreased west of 150°E. The eastern EP upper 300 m heat content anomaly became more strongly negative during October, reaching the lowest values of 2020. Positive outgoing radiation anomalies (OLR) occurred across the EP from 140°E to 180°E/W. Negative OLR anomalies persisted over Indonesia. Going into the Southern Hemisphere summer, a large part of global negative SSTo anomaly (>-2.0°C) was south of the equator and the largest areas of these anomalies were in the EP and the eastern south Pacific. Off South America, negative SSTo anomalies extended meridionally from the equator to the Antarctic sea ice edge. Zonal extent of the negative SSTo anomaly was from the coast of South America to 170°E at the equator, to 150°W at 10°S, to 110°W at 30°S and 90°W at 50°S. A wide band (10°-40°S) of predominately positive SSTo anomaly occurred meridionally between New Zealand and Australia, extending north into Indonesian waters. https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/
https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf
https://coastwatch.pfeg.noaa.gov/elnino/coastal_conditions.html (current)
https://coastwatch.pfeg.noaa.gov https://climatereanalyzer.org/wx/DailySummary/#sstanom (current)
https://www.ospo.noaa.gov/Products/ocean/sst/contour/index.html https://psl.noaa.gov/data/gridded/data.noaa.oisst.v2.highres.html

During late October **Sea level height anomaly** (SLA) showed many of the aerial features seen in previous months. The SLA patterns were similar to those observed in SSTo (above). Coastal SLAs were negative along the coast of North and South America between 30°S-40°N. These areas extended to 160°E at the equator and to 125°W at 20°S. In the western Pacific, positive SLA anomaly (≤20 cm) occurred north from 20°S across the equator into Indonesian Seas.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ocean/weeklyenso_clim_81-10/wksl_anm.gif (current)

The NOAA **Oceanic El Niño Index** (ONI) (3-month running mean of ERSST.v5 anomalies in the Nino 3.4 region) during May-June July (MJJ), JJA, JAS and ASO were -0.2, -0.4, -0.6 and -0.9 respectively, tending toward La Niña conditions.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf https://psl.noaa.gov/enso/mei/
https://climatedataguide.ucar.edu/climate-data/multivariate-enso-index (alternate El Niño index)

The NOAA/PSL **Southern Oscillation Index** (SOI) values for January-October 2020 are 0.30, -0.10, -0.20, 0.30, 0.70, -0.60, 0.70, 1.80, 1.50. Positive values are associated with negative phase ENSO (La Niña). https://psl.noaa.gov/data/correlation/soi.data
https://psl.noaa.gov/site_index.html#s https://www.longpaddock.qld.gov.au/soi/

The NOAA/NCEI **Pacific Decadal Oscillation Index** (PDO), calculated from the North Pacific ERSST.v5 was -0.52, -0.75 and -0.81 during May through July, respectively. PDO dipped to -1.20 and -1.01 in August and September, respectively. Then increased again to -0.58 in October. The PDO often reflects equatorial variability.
https://www.ncdc.noaa.gov/teleconnections/pdo/ ,

The **Pacific / North American Teleconnection Index** (PNA), computed from atmospheric pressure over the Pacific Ocean and North America had mainly negative daily values during October, with a monthly "Historical PNA index" of -1.08. Negative phase PNA is associated with negative phase ENSO. https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (Historical Index) https://www.cpc.ncep.noaa.gov/data/teledoc/pna.shtml (computational alternatives).

October monthly ERD/SWFSC coastal **Upwelling Indices** (UI) remained upwelling favorable (positive) but weaker than average from 27°N to 33°N in patterns persistent during summer and fall 2020. However, upwelling favorable UI conditions at 39°-51°N were stronger than average during October.
https://upwell.pfeg.noaa.gov/products/PFELData/upwell/monthly/table.2010
https://oceanview.pfeg.noaa.gov/products/upwelling/dnld (current)

PRECIPITATION and RUNOFF

Drought conditions remained in southern Oregon and California, but Washington and southern Canada had about average rainfall during October, the first month of the "Water Year.". Columbia Basin rain was 63%-163% of normal (1.0-4.8 inches or 25-120 mm). Western Washington had 5.3-15.9 inches for 58-162% of normal. Discharge of Washington coastal rivers increased (see below). Western Oregon had 0.8-5.2 inches, about 24%-82% of normal. California north coast locations received as much as 6 inches precipitation, but generally northern California received less than 2 inches and remained at 10-25% of normal.
https://droughtmonitor.unl.edu. https://waterdata.usgs.gov/ca/nwis/nwis
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4
https://waterdata.usgs.gov/ca/nwis/current/?type=flow https://watermonitor.gov/naww/index.php
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml

Northwest and Washington River Discharge

Fraser River discharge, measured at Hope (130 km upriver from Vancouver, B.C.) increased to a maximum of 3,800 m^3/s in mid-October, fell to 2,000 m^3/s on 28 October, then increased to 2,400 m^3/s (85,000 cfs) by 31 October. Median discharge for this station during the highly variable fall discharge period is 1,800 m^3/s. The **Queets** at Clearwater, Washington was flowing at 3,070 [3,489/ 1,759 cfs] [historical median/ change from September to **October** as cfs in brackets]. The **Puyallup** at Puyallup was flowing at 1,940 [1,870/ 1221 cfs]. **Skagit** flow was 20,500 [12,800/ 8,600 cfs] near Mount Vernon. **Stillaguamish** discharge was 1,660 [1,380/ 1,157 cfs] at Arlington. **Columbia** transport was 16,000 (tidal) [115,000/ -9,700 cfs] at Vancouver.

Oregon River Discharge

The **Columbia** at the Dalles, Oregon was discharging 96,900 [102,000/ -28,000 cfs]. The **Wilson** at Tillamook, was flowing at 232 [575/ -18 cfs]**.** At Elkton, **Umpqua** transport was 923 [1,520/ 10 cfs]. **Rogue** River flow was 1,130 [1,500/ -10 cfs] at Grants Pass and 1,410 [1,930/ 0.0 cfs at Agness.

California River Discharge

The **Klamath** near Klamath was transporting 2,400 [4,260/ 40 cfs]. **Smith** discharge was 193 [520/ -7 cfs] near Crescent City. The **Eel** at Scotia had 72 [136/ 14 cfs] transport. **Battle Creek,** Coleman National Fish Hatchery, flow was 250 [282/ 18 cfs]. **Butte Creek** at Chico had 66 [125/ cfs] transport. **Sacramento** River transport was

6,530 [9,520/ -2,530 cfs] at Verona and -495 (tidal) [11,400/ -7,425 cfs] at Freeport. **San Joaquin** flow was 1,730 [1,940/ 1,193 cfs] at Vernalis. **Pescadero** Creek transport was 2.7 [2.7/ 1.7 cfs] near Pescadero. **San Lorenzo** discharge was 8.4 [14/ -0.4 cfs] at Santa Cruz. The **Pajaro** at Chittenden was flowing at 2.6 [5.3/ 0.2 cfs]. There was no measurable surface flow in the lower **Salinas** and **Carmel** Rivers. The **Big Sur** River discharged at 16 [17/ 1.0 cfs] near Big Sur, California in. the final days of October
https://droughtmonitor.unl.edu. https://waterdata.usgs.gov/ca/nwis/nwis
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4
https://waterdata.usgs.gov/ca/nwis/current/?type=flow https://watermonitor.gov/naww/index.php
https://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/global_precip_accum.shtml
https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4
https://www.wrh.noaa.gov/cnrfc/rsa_getprod.php?prod=RNORR4RSA&wfo=cnrfc&version=0

Note for October

The open space fire (wildfire) season in the western coastal US was the most extensive on record. Five of the six largest fires recorded for California forest lands occurred during August-October 2020. More than 4 million acres (16,200 km^2) burned in California. Oregon and Washington also had an extensive fire seasons with more than 3,000 fires burning more than 8,000 km^2 during August-October. Seasonal rains have reduced wildfire hazard in Washington and Oregon, but wildfires continue in California. To characterize fires, the VIRS (Visible Infrared Imaging Radiometer Suite) satellites measure fire radiative power, or FRP (megawatts of heat released by a fire). For the 2020 fires, the FRP was 80% higher than the average FRP recorded during the fire seasons of 2012 through 2019. The highest FRP value (1.2 million megawatts) for all fires in the California, Oregon and Washington occurred on 8 September 2020. “Fires of this intensity can release 20 to 40 tons of particulate matter into the atmosphere in one second," said S. Kondragunta, a physical scientist at NOAA/NESDIS/STAR. The fire smoke and debris will have many effects, some renewing and enriching, in streams, rivers, estuaries and the coastal ocean, for 3-10 years. These effects will be added to persisting effects of previous fires. Dissolved organic carbon, and a wide range of chemicals are released by fires. Without trees, vegetation, and a stable soil structure to absorb the precipitation, tons of ash, debris, heavy metals, and nutrients flush through watersheds. Erosion after severe wildfires can be the dominant force shaping mountainous landscapes. Mud, rich in nitrogen and phosphorous that accumulates after fires may drive an uncharacteristic growth of (sometimes toxic) algae in upland creeks and streams, modifying generally low-nutrient ecosystems. Intense fires, such as those of August-October 2020 can further damage the ecology of waterways by exposing them to the sun’s heat, exacerbating flooding and erosion and introducing additional toxins, such as mercury, lead and cadmium (often liberated from soil, tree trunks and burned structures) into aquatic food webs. Ecosystem changes from fires occur from headwaters to ocean terminus, where the coastal ocean is increasingly impacted.
Also of interest at sciencemag.org, DOI: 10.1126/science.370.6512.18, DOI: 10.1126/science.abf0544, DOI: 10.1126/science.366.6468.937
https://odfwildfire.wpengine.com/2020/10/19/final-odf-fire-report-for-2020-fire-season/ https://www.dnr.wa.gov/Wildfires
https://deqblog.com/2020/09/16/wildfire-smoke-brings-record-poor-air-quality-to-oregon-new-data-shows/
https://www.motherjones.com/environment/2020/09/these-5-stats-show-just-how-devastating-californias-wildfires-have-been-so-far/
https://www.star.nesdis.noaa.gov/star/index.php https://www.star.nesdis.noaa.gov/star/news2020_202010Smoke.php
https://e360.yale.edu/features/how-wildfires-are-polluting-rivers-and-threatening-water-supplie
https://www.fire.ca.gov/media/11416/top20_acres.pdf